

Western's monthly energy efficiency and renewable energy newsletter dedicated to customer activities and sharing information on energy services.

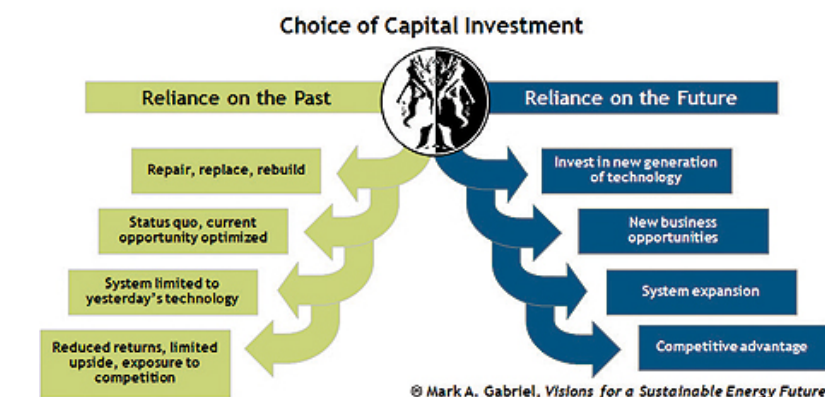
Understanding what smart grid means for utilities

Ask a utility professional to define “smart grid,” and chances are, you will get a stammered explanation or even perplexed silence, because the industry has yet to come up with—or even agree on—what the smart grid is.

Part of the problem is that a smart grid is not a single concept or technology, but rather like a basket containing various balls. The Illinois Smart Grid Initiative describes the “basket” as the modernization of the electric system through integration of new information-age technologies and strategic public policies to deliver more efficient operation, more efficient use of grid assets and more cost-effective expansion of the electric grid for the benefit of both the utility and the consumer. The “balls” fall roughly into three categories:

- Smart devices
- Two-way communications
- Advanced control systems

Some elements already exist and are being deployed and used by utilities,



Utilities today must decide whether to move ahead and invest in new technology that bears some risk, or to replace infrastructure with older, but more established equipment. (Artwork by R.W. Beck)

ties, while others are still in development. The confusion occurs because most people refer to a particular technology when they talk about the smart grid, rather than an entire system—never mind the policies and outreach that will be necessary to make the system work. Utilities must overcome this confusion if the industry hopes to reach the vision of a grid that allows us to manage our resources more effectively.

Old grid won't do

The reasons we need a smarter grid are threefold, according to Mark Gabriel, senior vice president of energy for infrastructure consultant R.W. Beck. “First, customers want new ways to do business with all of their service providers,” he said. The Internet and cellular communication have changed the way consumers buy

everything, from groceries to vacations, and they are going to expect the same kind of control and flexibility from their utilities. “The old grid system won’t be able to meet those expectations.”

System operations and reliability are the second issue. “We have to maintain the infrastructure—that’s a fact of life,” Gabriel stated. “And if you went to replace your computer, you wouldn’t buy one that’s 10 years old. You would get the state-of-the-art model that is compatible with the programs and equipment that everyone else is using.”

Finally, Gabriel noted, inevitable carbon legislation will demand that we use the grid more creatively. “The reality is that we will be building fewer conventional power plants and

See SMART GRID page 2

What's inside

CUE Exchange	3
Online IRP update	5
Technology Spotlight.....	6
Web site of the month	7

Smart grid *from page 1*

relying more on renewables, many of which are intermittent resources. You can't do that without a smart grid."

Get there from here

The good news for utilities is that a smart grid can be reached incrementally—in fact, it can't be built all at once, said Gabriel. "The smart grid requires the integration of many elements, so it has to happen over a period of time," he explained. "Utilities will be able to add appropriate technologies in a 'no regrets' fashion."

It is already happening, helped along by funding from the American Recovery and Reinvestment Act, but also by simple attrition. When building a new substation or replacing an old transformer and the surrounding components, a utility has the choice of building the old way or adding intelligence at that level.

"Those are assets that will be on the system a long time, so it is important to look forward and choose equipment that provides the most functionality," advised Dave Berg, R.W. Beck national director of rates

valuations and finance. "Even if you can't use the function initially, system components have a lifespan of up to 40 years. Don't box yourself in."

Customers get on board

Among the forward-looking utilities are several Western customers, including Anaheim Public Utilities, Salt River Project and Turlock Irrigation District. Most of those projects focus on the proven technology of advanced meter reading (AMR). That makes sense, said Berg, who spoke at the Minnesota Municipal Utilities Association on what the smart grid means to public utilities. "Utilities will be solving more and more of their power supply problems on the customer side of the meter, and AMR gives customers and utilities the ability to communicate with each other," he observed.

"This technology provides customers with a better understanding and management of their consumption, and more hands on control over the cost of their monthly bills," said Jerry Forte, Colorado Springs Utilities' chief executive officer.

The municipal utility started its AMR project four years ago, and has only 80,000 meters left to install. At full deployment in 2010, more than 530,000 smart meters will have been installed.

In South Sioux City, Neb., AMR and load management technology offer a way of coping with demand that is expected to triple in the next three years. A feasibility study the city commissioned to determine the cost and payback of adding those capabilities to its grid put a \$4 million price tag on the upgrade. The city has an extensive fiber optics network and high penetration of non-line-of-sight wireless services, so most of the

infrastructure is already in place. "The study showed that would be a sound investment for the city, and most importantly, for our customers," said City Administrator Lance Hedquist.

Still, progress in implementing the plan has been slowed by the need to build a new electrical substation. Hedquist added that the city submitted a grant for some funding assistance under the stimulus program and is awaiting word on its application.

Making the case

Clearly, bringing the grid up to 21st century standards will cost, and it will largely fall to utilities to explain to stakeholders why it will be worth the money.

As the Colorado Springs Utilities press release pointed out, its AMR system will give customers more control over their energy use, along with more accurate billing. Customers can expect quicker response to service problems, and the additional infrastructure will make it easier to add renewable generation systems to homes and businesses.

Lower labor costs, greater customer satisfaction and seamless load control associated with two-way communication add up to cost savings for utility and grid operators. The smart grid can make system planning and maintenance more efficient, while reducing theft and energy loss. Perhaps most importantly, utilities will be able to use existing infrastructure to effectively manage load, thus delaying or even avoiding building costly new power plants and transmission lines.

And the benefits keep rippling out through the community, the state and the environment. Greater reliability and shorter outages can reduce the

See SMART GRID page 4

Energy Services Bulletin

The Energy Services Bulletin is published by Western Area Power Administration for its power customers. The mailing address is Western Area Power Administration, P.O. Box 281213, Lakewood, CO 80228-8213; telephone (720) 962-7508.

The mention of any service, product, or technology does not constitute an endorsement of same and Western, the Department of Energy, or the United States Government cannot be held responsible or liable for use thereof.

Editor: Kevon Storie
Designer: Grant Kuhn

Talk efficiency, share best practices at CUE Exchange

That nip in the air and leaves turning to gold in Colorado's high country can mean only one thing—it is time for Rocky Mountain utilities to head up to Aspen for the Colorado Utility Efficiency (CUE) Exchange, Oct. 21 to 23.

Now in its third year, the CUE Exchange brings utilities, energy organizations and trade allies together at beautiful Aspen Meadows Resort to talk about how to design and implement successful customer efficiency programs. The relaxed setting (and low, off-season price!) encourages attendees to share, question, brainstorm and connect with other professionals whose program, service or technology just might hold the key to big energy savings.

The ongoing theme of the CUE Exchange is tearing down the barriers—between energy-efficiency, conservation and renewable energy programs; between residential and commercial programs; between consumers and utilities and between neighboring utilities, municipalities and state and Federal agencies. “The focus is on energy efficiency, but more importantly, on not developing programs in isolation,” explained Event Director Ed Thomas. “Any time a utility can leverage another agency's efforts, or an organization partners with a utility, it spreads the message a little farther and increases the program's chances for success.”

The tried and true

Past Exchange participants will recognize the format. The agenda opens Wednesday, Oct. 21, with optional pre-conference workshops—one presented by Western on the new online IRP reporting system. The



LEED Gold-certified Doerr-Hosier Conference Center at Aspen Meadows Resort awaits the 2009 CUE Exchange. (Photo by Dolce Aspen Meadows Resort)



Energy Services Manager Ron Horstman (left) enjoys a panel discussion at the 2008 CUE Exchange. (Photo by Tiger Adolph)

main event begins with a buffet lunch, followed by a keynote address from Jeffrey Ackerman of Colorado Public Utilities Commission (PUC) on the new frontiers of demand-side management (DSM). “The PUC and the Colorado Governor's Energy Office are coordinating their remarks to set the stage and then wrap up the Exchange, this year,” said Thomas.

The afternoon will be dedicated to examining utility program portfolios. Xcel Energy, Black Hills Energy and the municipal utilities of Aspen and Fort Collins, Colo., are among the presenters. In between sessions, participants have the opportunity to

highlight their pet programs during the popular five-minute “Utility Snapshots.”

Thursday will be dedicated to the concurrent session tracks introduced in 2008. “The morning tracks focus on commercial and residential issues, and the afternoon sessions incorporate broader issues like smart grid, project finance and green collar workforce development,” said Thomas.

Attendees come together again on Friday to discuss program integration, emerging technologies, program evaluation and late-breaking news before the Exchange concludes at

See CUE EXCHANGE page 4

CUE Exchange

from page 3

noon. As in past years, there will be plenty of time for networking during meals, breaks and receptions.

What's new?

Don't get the idea that the CUE Exchange is resting on its laurels—the program advisory committee is always looking for new ways to give attendees a little more.

Expanding the concurrent session tracks to a full day will open up new fronts for discussion. “Attendees told us last year that they really enjoyed the broader choice of topics that dual tracks offered,” said Thomas. “When program integration is the overarching theme, there's always something more to talk about. Adding more concurrent sessions lets us cover more ground.”

The poster session is another new feature that promises to make the always-enjoyable Wednesday night networking reception even livelier. Thomas's first experience with a poster session at a utility exchange came at the Utility Energy Forum

in Lake Tahoe last May. “It was a neat way to get more attendees involved in creating the agenda,” he recalled. “Not everyone has a whole presentation's worth of information, or feels comfortable addressing a large group. The poster session is an opportunity for these people to share their ideas in a more informal way.”

Sponsors return

Sponsorship is another way to be a part of the CUE Exchange, and many organizations that sponsored and presented at previous exchanges will be back this year.

The city of Aspen Utilities is once again hosting the event. Returning sponsors cover the industry spectrum, from government agencies like Western and non-profit organizations like Electric & Gas Industries Association to trade allies like Marathon Water Heater and, of course, utilities—investor-owned as well as public power.

Green sponsor Platte River Power Authority has played active role in planning since the first CUE Exchange in 2007. This year, representatives from Platte River member-owners Longmont Power

and Communications and Fort Collins Utilities will be joining their power wholesaler as presenters and session chairs.

The CUE Exchange keeps growing, Thomas noted, because past sponsors, exhibitors and attendees keep inviting their members, customers and colleagues to join in the conversation. Western, for example, works closely with DOE's Industrial Technologies Program (ITP), and this year, ITP is sponsoring the Exchange.

“One noticeable outcome over the last three years is a strengthening of existing partnerships,” said Thomas. “Agencies that have collaborated on past projects meet up at the Exchange, start talking and find new ways to work together.”

Whether you are from a Colorado utility or a neighboring state, the Colorado Utility Efficiency Exchange is the place to share ideas, meet new partners and reconnect with old ones. Register online, or call Sharon Dobson at 719-205-0071 with registration questions. For sponsorship information, call Juanita McConkey at 719-641-2579. See you in Aspen! ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2009/oct/oct092.htm

Smart grid

from page 2

burden on local fire, police and other city resources that must help with such events. A modern electricity infrastructure that supports the

integration of renewable resources will help states meet mandates and reduce greenhouse gas emissions.

And there is much more, but the benefits of smart grid technology won't communicate themselves. There are plenty of resources—and,

not surprisingly, conflicting information—on the Web. Read Web site of the Month: Smart grid round up to start your own research. ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2009/oct/oct091.htm

Update: Online IRP reporting system rollout moves forward

Earlier this year, Energy Services asked our customers to help test and refine our new online IRP reporting system. You answered the call, and your input has been incorporated into the finalized program going live Westernwide Oct. 1.

The system provides a Web-based, pre-approved format for submitting the annual report Western customers are required to file. Customers reporting under alternative plans—the Small Customer Plan, Minimum Investment Report or Energy Efficiency and/or Renewable Energy Report—will also be able submit their annual reports online. In the very near future, this system will also allow customers to submit 5-year plan information. Customers will be notified when this feature is available for use.

UGP's pioneer spirit

Upper Great Plains (UGP) customers were the first to try out the voluntary system, which Energy Services representatives can use to notify customers when their IRP annual reports are due. UGP Representative Mike Radecki has sent out about 40 notifications, and 17 customers have registered so far.

The early adopters were a big help in pointing out where instructions were not as clear as they could be. “Those customers deserve our thanks for helping to make the system a little more user-friendly,” Radecki observed.

“We’ve done a lot of fine-tuning, and now the biggest hurdle is just getting started,” he added.

The second biggest hurdle—forgetting how the system works in the 12 months between reports—can be overcome by the cloning feature. “Customers can create their next annual report by simply copying the prior year report and updating the information—that function will definitely relieve their reporting burden,” declared Radecki.

Into the (data) pool

Utility professionals are notoriously busy, so many customers will wait until they receive notice of their reporting deadline to investigate the online system. However, you can register anytime and explore the program at your leisure.

Basic information on each Western customer is already in the database, but users will have to enter their own IRP annual report data, and provide the name of their designated contact who will receive notifications. As a way of becoming acquainted with the system, you could enter your utility’s previous IRP annual report. When the time comes to do a new report, your old one will be waiting there for you to clone.

Another great feature, said Energy Services Manager Ron Horstman, is that customers will be able to compare prior annual reports to see how their integrated resource plan is performing from year to year. “There are so many

functions on this system that will save our customers time and add value to the planning process. They just have to take the first leap and try it out.”

Help is on the way

A lot of people face the prospect of learning a new computer program with more than a little trepidation. Take comfort—we don’t expect our customers to go it alone if they don’t want to.

Customers attending the Colorado Utility Efficiency Exchange in October can get an introduction to the online reporting system at the pre-conference workshop presented by Rocky Mountain representative Linda Swails. Western may offer additional workshops if enough customers express an interest in formal training.

Of course, your regional Energy Services representative is just a phone call away. “Many customers may opt to walk through the online submission process with their representative one-on-one when their next annual report is due,” acknowledged Swails. “It is important for everyone to be comfortable with this tool so they can get the most benefits from it.” ⚡

Want to know more?
Visit www.wapa.gov/es/pubs/esb/2009/oct/oct093.htm

Technology Spotlight:

Industrial waste heat recovery technologies for moderate temperatures

Many industrial processes require large quantities of thermal energy, much of which is eventually exhausted into the environment, either into the atmosphere or water. Recovering this waste heat represents the largest opportunity for reducing industrial energy consumption in the United States.

Since the majority of waste heat sources have temperatures below 1,000° F, it is especially important that we implement technologies suitable for low to moderate temperatures. The old rule of thumb that industrial heat recovery is cost effective only for temperatures of at least 1,000° F is not true today with increasing energy prices, technological development by equipment manufacturers and decreasing equipment costs. There are a number of technologies for recovering heat from moderate temperature sources less than 1,000° F.

Heat recovery options can be broadly classified into three strategies:

- Recycling energy back into the process
- Recovering energy for other on-site uses
- Generating electricity in combined heat and power (CHP) systems

Heat recovery technologies may also be classified as either passive or active. Passive heat recovery uses various types of heat exchangers to transfer heat from a higher temperature source to a lower temperature stream. Passive heat recovery technologies do not require significant

mechanical or electrical input for their operation, except for auxiliary equipment such as pumps or fans. Active heat recovery technologies on the other hand require energy input to “upgrade” the waste heat to a higher temperature or to electricity. These technologies include industrial heat pumps and combined heat and power systems.

Waste heat use is largely determined by its temperature, with different types of equipment appropriate over different temperature regimes. Other considerations are flow rate, waste heat availability over the course of the day and year and the fouling characteristics of exhaust. Technologies and strategies to manage corrosive, abrasive, and/or fouling exhausts include material selection, heat exchanger design, automatic washers, soot blowers, acoustic horns, pulse detonation, mechanical surface cleaners and filtration systems.

Greater than 200° F

When investigating heat recovery opportunities, first consider ways to reduce the quantity of waste heat the system produces by improving the efficiency of the process. Next, for waste heat temperatures greater than about 200° F, consider passive heat recovery strategies, which are generally cheaper to install and simpler to implement and maintain than active recovery systems.

Examples of passive heat recovery are:

- Preheating boiler make-up water using a feedwater economizer

- Preheating the supply air into a process such as a food dryer by passing its supply air and exhaust through an air-to-air heat exchanger
- Preheating combustion air
- Using the flue gases from a furnace or dryer to preheat the load entering it
- Using waste heat from a process to meet other in-plant needs such as space heating, water heating, recharging the media in desiccant dehumidification or heating other lower temperature processes

Passive heat recovery strategies often can be used in conjunction with active strategies. For example, if a heat exchanger precedes a heat pump in recovering heat from an exhaust stream, the heat pump can be smaller and will consume less energy and require a lower first cost to achieve the same temperature rise. A CHP turbine is another example of heat recovery downstream.

Less than 200° F

Closed-cycle mechanical heat pumps are suitable for heat recovery from waste heat streams less than about 200° F. They mechanically compress refrigerant to heat the supply air or water of a process to a temperature greater than the temperature of the waste heat source (i.e. achieve a temperature lift.) Industrial heat pumps may be used to recover heat from waste streams in such processes as drying, washing, evaporating and

See SPOTLIGHT page 8

Web site of the month: Smart grid roundup

So you want to learn more about the smart grid—what it is, what it can do for you and what it can do for your customers. Like any modern professional, you log on to the Internet and google “smart grid.” Up pop about two and a half million results, several stirring up controversy and even more offering to sell you components. Before you wade into the debate or buy something, learn the basics at these Web sites.

Educate yourself

DOE's National Energy Technology Laboratory hosts Modern Grid Strategy, which provides a good overview of the issues. Start with What is the Smart Grid?, a paper that lists the capabilities of a modernized transmission system and milestones for reaching that goal. Papers that go into more detail on smart grid characteristics, key technologies, benefits and barriers will round out your education. There is also an excellent video explanation, “Powering the 21st Century Economy,” to help you introduce board members and customers to the concept of the smart grid.

An in-depth discussion on the need for a smart grid, along with recommendations for transforming the nation's grid, can be found in Smart Grid: Enabler of the New Energy Economy. The report by DOE's Office of Electricity Delivery and Energy Reliability addresses barriers and opportunities to deploying smart grid technologies. *(Note: Make this report*

available to your board members when it is time to talk specifics about upgrading your system.)

Of course there are many aspects of smart grid technology and deployment that are still evolving, and you can follow the progress through the Smart Grid Interoperability Standards Project. The National Institute of Standards and Technology (NIST) is coordinating the project to develop a framework of protocols and model standards for information management to achieve interoperability of smart grid devices and systems. U.S. Commerce Secretary Gary Locke and NIST presented the draft report, NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0, for public comment at the GridWeek 2009 Conference Sept. 24. Stakeholders have 30 days to review the report and learn about next steps, and provide public comment.

Ready to take action

With a clearer understanding of the smart grid vision, it's time to dive into the practical and logistical side. Smart Grid News (SGN) offers a wealth of resources for utilities that are ready to start implementing smart grid strategies. The online newsletter covers the latest news and analysis of key developments in the smart grid sector. Features like the SGN scorecards can help you evaluate appropriate technologies. Use the resources in the business section to make your case for



Smart Grid News is an excellent resource for utilities that want to keep up with the latest news, technologies and policies for building out the 21st century electricity delivery system. (Artwork by Smart Grid News)

implementation, and news about the American Recovery and Reinvestment Act (ARRA) in the stimulus section to access funding for modernizing the electric grid. And best of all, the subscription is free.

No sea-change can take place without the visionaries who take the first steps. Smart Grid City, a joint project between Boulder, Colo., and Xcel Energy, is the nation's first fully integrated smart grid community and will boast the largest and densest concentration of these emerging technologies to date.

To accomplish this ambitious task, Xcel Energy formed the Smart Grid Consortium, an eclectic mix of industry consultants, broad-solution portfolio providers and innovative specialized technology vendors. You can follow the project on the SmartGridCity Hub, and learn from Xcel Energy's experience as the utility expands smart grid programs to other areas the company serves. ⚡

Want to know more?
Visit www.wapa.gov/es/pubs/esb/2009/oct/oct095.htm

Spotlight *from page 6*

distilling. They can also produce steam and provide process water heating and cooling. This application is particularly suited for moist exhaust streams because the heat pumps can recover both the heat associated with the waste stream's temperature ("sensible heat") and the heat associated with its humidity ("latent heat"). Mechanical vapor compression heat pumps can achieve a very high coefficient of performance (COP) when the temperature lift is small.

200° F to 400° F

Absorption technology operates on thermal energy rather than mechanical shaft energy. Absorption units are referred to as absorption chillers when they provide air conditioning or refrigeration using waste heat as an energy source. The same technology is called Type-1 absorption heat pumps when the application is to transfer heat from a higher-temperature source to bring a low-temperature supply stream to an intermediate temperature. Absorption chillers/heaters are designed to switch between heating and cooling modes. Absorption technology is most economical using a waste heat source ranging from approximately about 200° F to 400° F, especially if there is a need for simultaneous heating and cooling. The growing interest in waste heat recovery is driving a resurgence in absorption technology. U.S. manufacturers

have all introduced expanded lines of absorption chillers and chiller/heaters ranging from three tons to more than 1,500 tons.

200° F to 1000° F

Technologies for generating electricity from moderate temperature heat sources include Organic Rankine Cycle (ORC) systems and Kalina cycle systems. Generally speaking, the higher the source temperature, the greater the capacity and cost-effectiveness of the CHP system. As a rule of thumb, CHP systems are often difficult to justify economically for waste heat sources less than about 400° F. CHP systems for moderate temperatures have greater installation costs than reciprocating engines of the same size, but that expense may be offset by lower maintenance costs and zero fuel costs for waste heat recovery.

ORC systems can be compared to conventional steam turbine systems, except that its working fluid is a refrigerant instead of water. The operating temperatures of ORCs vary depending on the manufacturers' design but typically range between 300° F and about 750° F. Typically, installed costs range from \$2,000 to \$4,000 per kilowatt and can be as low as about \$1,300 per kilowatt for the "HVAC-derivative" units now appearing on the market. ORCs have been used in geothermal applications and as the bottoming cycle for steam power plants for over 40 years. Industrial waste heat recovery systems using

ORC turbines at cement kilns and compressor stations have operated since 1999.

The Kalina cycle technology, distributed by Raser Technologies in the United States, is practical over a wider temperature range – 250° F to 1,000° F – than ORC, and is 20 to 40 percent more efficient than either an ORC or steam turbine for temperature sources less than 1,000° F. Installed costs typically range from \$2,000 to \$3,000 per kW. Like the ORC, the Kalina cycle has been used at geothermal plants and as the bottoming cycle of gas turbine and steam power plants. Kalina cycles using industrial waste heat as an energy source operated trouble-free since 1999 at a steel plant and since 2005 at a hydrocarbon plant.

References

- *Industrial Heat Pumps for Steam and Fuel Savings*, DOE Office of Energy Efficiency and Renewable Energy, Industrial Technologies Program, June 2003.
- *Process Heating Assessment and Survey Tool (PHAST)* Version 2.0 introduces methods to improve thermal efficiency of heating equipment.
- *Improving Process Heating System Performance: A Sourcebook for Industry*, DOE EERE, Industrial Technologies Program, Revised February 2008. ⚡

Want to know more?
Visit www.wapa.gov/es/pubs/2009/oct/oct094.htm